Amendments to the Specification

Please replace the "Detailed Description of Embodiments" section of the specification with the following marked-up "Detailed Description of Embodiments":

DETAILED DESCRIPTION OF EMBODIMENTS

Embodiments of the present invention will now be described with reference to the drawings. In the various embodiments described below like reference numbers will be used to indicate like features throughout the drawings.

Referring to Fig. 1, there is shown a cylindrical housing (2) into each opposite end thereof is located a three jawed chuck (3) and an outer piston (4), respectively. An hydraulically operable inner piston (5) is located for sliding movement within the piston (4). The three jawed chuck co-operates with a flaring head tool (6) mounted on a tool holder (7) movable in a diametrical direction of the cylindrical housing (2) through diametrically opposed windows (2c) thereof (Fig. 2). A helical compression spring (8b) is located on a reduced diametrical elongate cylindrical portion (5a) of the hydraulic inner piston (5) and a boss (9) is provided at one end of the cylindrical housing with radially extending threaded holes (9b) to hold the parts (4, 5) within the cylindrical housing and is locked in position within the housing by engagement screws (2a) which extend through holes (2b) in the housing into the holes (9b) of the boss (9).

Chuck clamp (10) is secured relative to the housing, at the opposite end of the housing to that end at which boss (9) is located, by screws (2d) ~~(2a)~~ engagable through the housing in radially extending screw threaded apertures (10e) at the outermost end of the chuck clamp (10).

The chuck clamp (10) has an external cylindrical surface of a diameter complementary with the diameter of the internal cylindrical surface of the housing (2), so as to be easily slidable into the housing. The screws (2d) ~~(2a)~~ hold the chuck clamp securely within the housing.

An aperture (10d) is shown in the outer end face of the chuck clamp (10) and an internal surface of the chuck clamp diverges outwardly towards the

innermost end face (10c) of the chuck clamp (10) relative to the housing (2). A generally central section of the internal surface of the chuck clamp extends parallel to the axis of the housing (2) and with the ~~clamping~~ chuck (3) defines a recess (10f) in which spring (8a) is located. As will be hereinafter described end face (10c) acts as a stop to prevent further inward movement of outer piston (4) relative to housing (2) when outer piston (4) moves under hydraulic pressure applied through boss (9). End face (3h) of chuck (3) aligns with end face (10c) when the chuck and chuck clamp are fully engaged together.

In Figure 3, a pipe (11) is shown located within the three jawed clamping chuck (3) with the open end (11b) of the pipe flared following interaction, as will hereinafter be described with the flaring ~~head~~ tool (6). As shown in Figure 4, at the opposite end of the housing (2) to the chuck clamp (10) a flexible pipe (12) extends from the housing via aperture (9c) in ~~end~~ boss (9) and is used to vary hydraulic pressure applied to the pistons (4, 5). The pipe (12), as shown in Fig. 5, is connected via a connection (13) to a hydraulic pump (14) having a mechanical drive (15) operable by an operator's foot. The respective ends of the pipe (12) are sealingly fitted in screw threaded engagement with appropriate sealing elements in a manner which is well known in the art, which does not form part of the present invention and which will therefore not be described further.

As shown more clearly in the part sectional perspective views of Figs. 2 and 3, the ~~clamping~~ chuck (3) substantially fits within a tapered aperture (10d) within the chuck clamp (10). Helical compression spring (8a) is located in the recess (10f) defined between the ~~clamping~~ chuck (3) and the chuck clamp (10) so as to push the ~~clamping~~ chuck (3) outwardly relative to the chuck clamp (10), inwardly into the housing (2).

As shown in Fig. 2 outer piston (4) has an external cylindrical surface which is of a diameter complementary with the internal cylindrical surface of the housing (2) and is arranged to slide longitudinally of the housing. Two seals (4a) are provided for sealing the outer piston relative to the internal surface of the housing (2). The outer piston (4) has an internal cylindrical aperture (4b) in which

there is located an annular seal (4c). Inner piston (5) is slidably engaged via its cylindrical surface (5a) with the aperture (4b), the seal (4c) sealing the inner and outer pistons one relative to the other.

The outer piston (4) also has a recess (4d) formed between two diametrically opposite axially extending arcuate portions of the cylindrical surface of piston (4). The two arcuate portions each have a flat inner surface diametrically opposed and lying parallel one relative to the other. Each arcuate portion has a transversely extending end face (4e). The tool holder (7) is located in recess (4d) for sliding movement back and forth in a diametrical direction of the piston (4). The windows (2c) on diametrically opposed sides of the housing (2) are arranged to align with the recess (4d) in the outer piston (4) to allow the tool holder in recess (4d) to extend outwardly of the housing (2).

As previously described the inner piston (5) slides within the inner aperture (4b) of the outer piston (4) and is sealingly engaged relative thereto by seal (4c). An increased diameter portion (5b) of the inner piston (5) serves as an end stop for helical compression spring (8b) located on the outer cylindrical surface (5a) of the inner piston (5) in a recess (5h) defined between the end stop (5b) and end face (4g) of the outer piston (4).

The inner piston (5) has a transverse surface (5f), innermost of the piston (5), relative to the housing (2). Two tool holder guides (5c) project outwardly from the surface (5f) and have large external surfaces and frustoconical support surfaces extending from the outer transverse surfaces thereof inwards towards the surface (5f). A detent (5d) located in an aperture (5e) between the two tool holder guides (5c) is operable to accurately locate the tool holder (7) in position on the guides (5c). The guides (5c) are located in groove (7a) of the tool holder (7). Such detents are not clearly shown in the tool holder (7) but one detent receiving recess (7e) is shown in the base surface (7f) of the groove (7a), illustrated at the end face (7g) of the tool holder (7). A whole series of the recesses (7e) are present along the surface (7f) so that the tool holder (7) can be accurately aligned anywhere along its length relative to the central axis of the elongate aperture (3b)

through the ~~clamping~~ chuck (3). In the rest position of the pistons the helical compression spring (8b) expands to force the inner piston (5) outwardly from the end of the outer piston (4).

The abutment surfaces (4e) of the outer piston (4) engage or abut end surface (3h) of the ~~clamping~~ chuck (3).

The tool holder (7) is also provided with apertures (7b) therethrough for receiving one end of a flaring tool (6). Upper surface (7h) of the tool holder (7) has a series of screw threaded apertures in which screws are located, one associated with each aperture (7b). Each flaring tool (6) has a groove (6a) at its end remote from the flaring tool working surface ~~end~~ (6b), into which a screw (7d) extends to hold the flaring tool on the tool holder.

The boss (9) located at the end of the housing (2) remote from the ~~clamping~~ chuck clamp (10) is, as previously discussed, held relative to the end of the housing by screws (2a) in screw threaded apertures (9b). A sealing ring (9a) serves to seal the boss (9) relative to the housing (2). Threaded centrally located aperture (9c) receives one end of pipe (12) which is sealed relative to the boss (9) in any suitable manner known in the art as mentioned above.

The relative position of the various components of the automated pipe flaring tool (1) are shown in Fig. 2 to be in a rest position in which both compression springs (8a, 8b) are in their fully expanded conditions. The operation of the flaring tool (1) will now be described beginning from the rest position of Fig. 2 with an individual flaring tool (6) located in the central aperture (7b) of the flaring tool holder (7) and aligned with the longitudinal axis of the elongate aperture (3b) through the ~~clamping~~ chuck (3).

As may be seen from Fig. 3 a pipe (11) to be flared is located within the ~~clamping~~ chuck (3) until the end of the pipe engages the work surface ~~face~~ (6b) of the flaring tool (6) with the tool holder (7) in its rest position. This will be substantially level with end face (3h) of the ~~clamping~~ chuck (3). The positioning of the pipe in the correct position can be seen through the window (2c) in the housing (2).

As hydraulic pressure is applied to end face (5g) of the inner piston (5) via pipe (12) the spring (8b) partially compresses and then moves with inner piston (5) to move the outer piston (4) towards the chuck clamp (10). As the outer piston (4) moves towards the chuck clamp (10) its transverse end faces (4e) push against the end face (3h) of the ~~clamping~~ chuck (3) to move the ~~clamping~~ chuck inwardly of the chuck clamp. Such movement firstly has the effect of closing the three ~~elements~~ jaws of the ~~clamping~~ chuck (3) around the pipe (11) as the tapered outer surface thereof slides inwardly of the inner tapered surface (10a) of chuck clamp (10), to firmly hold the pipe in position. Secondly, the compression spring (8a) compresses by the inward movement of ~~clamping~~ chuck (3) into chuck clamp (10) and is thereby tensioned ready to push the ~~clamping~~ chuck (3) outwardly of the chuck clamp (10) once the hydraulic pressure is released.

Once the pipe (11) is firmly clamped by the ~~clamping~~ chuck (3) the outer piston (4) stops moving and the inner piston (5) continues to move compressing the spring (8b) further. The tool holder (7) fixedly mounted on the inner piston (5) for longitudinal movement therewith relative to the housing (2), moves the flaring tool (6) into the aperture (3a) of the ~~clamping~~ chuck (3). As the tool (6) continues to move into the aperture (3a) the end of the pipe begins to flare outwardly because of the frustoconical formation of working surface (6b) of the flaring tool (6). As the inner piston (5) moves towards the chuck clamp (10) the end of the pipe (11) is forced into contact with tapered inner surface (3c) of the ~~clamping~~ chuck (3). This provides the pipe (11) with a flared end (11b) as shown in Fig. 3.

When the hydraulic pressure is released the biasing forces within the springs (8a, 8b) begin to act with the spring (8a) forcing the ~~clamping~~ chuck (3) away from the chuck clamp (10). Simultaneously, spring (8b) which is initially moved by chuck (3) via outer piston (4) continues to move with the outer piston (4). Spring (8b) then begins to exert pressure and forces the piston (5) longitudinally outwardly relative to the outer piston (4). The effect of this is to withdraw the flaring tool (6) from the aperture (3a) of the ~~clamping~~ chuck (3).

During the release of the ~~clamping~~ chuck (3) from the chuck clamp (10) radially extending springs (not shown) located between the three chuck jaws of the ~~clamping~~ chuck (3) operate to force the chuck jaws apart thereby releasing the pipe (11) so that the pipe can be withdrawn through the ~~clamping~~ chuck (3) and chuck clamp (10).

Conveniently, a number of different flaring tools (6) can be mounted on the tool holder (7) so that the end of the pipe can be flared gradually to avoid splitting of the pipe for example, and to more accurately obtain the correct flaring angle.

Although the embodiment shown in Figs. 1 through 5 is described with reference to a single flaring, it may also be possible by appropriate shaping of the chuck (3) and working surface ~~face~~ (6b) of the flaring tool ~~head~~ (6) to use the same apparatus and method to perform a double or other flaring operation.

The three jawed chuck (3) is provided with a forming recess (3a) to assist in forming the flared end of a pipe and an elongate aperture (3b) ~~and~~ in which a pipe (11) (Fig. 3) is located.

Defouling of the pipe end is achieved by the slot (3c) on the chuck (3) and the loose material is ejected easily through the window ~~slots~~ (2c) in the housing.

Furthermore, the helical springs (8a,8b) can be of any mechanical/hydraulic form provided similar biasing action can be achieved as the springs (8a,8b).

Although in the presently described embodiment the inner piston is described as sliding centrally through the outer piston, the two pistons may be arranged substantially differently, side by side for example.